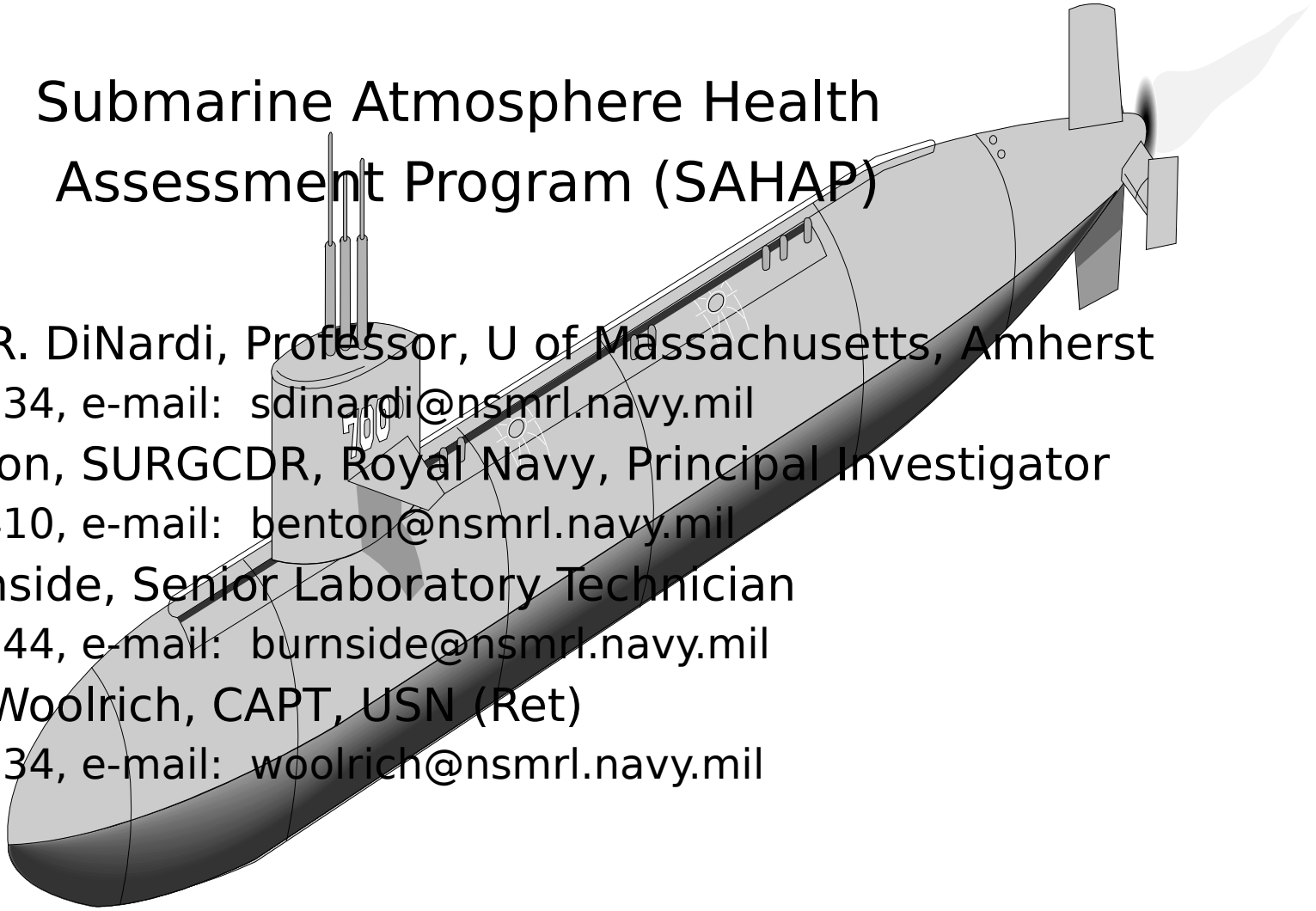
Naval Submarine Medical Research Laboratory (NSMRL)

Submarine Atmosphere Health Assessment Program (SAHAP)



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Purpose of Brief

Provide background information on the Submarine Atmosphere Health Assessment Program (SAHAP)

History: CNO Direction Initiating Program

CNO N87 wrote 9 Mar 95:

"… the U.S. Navy has insufficient knowledge regarding the total spectrum of constituents in the atmosphere of our submarines, and any long term effects of exposure to those constituents on our sailors."

ltr 6420 Ser N871/5U660109 of 9 Mar 95

SAHAP's Tasking

"Request that SUBLANT and SUBPAC authorize embarkation of the SAHAP passive monitors aboard all units deploying for operations greater than 28 days and grant direct liaison authority (DIRLAUTH) to NSMRL to enable SAHAP staff to brief ship and squadron staff and provide kits."

Commander, Naval Sea Systems Command ltr 9510 Ser 05Z9/053 dtd 30 June 2003

"SUBPAC authorizes direct liaison authority (DIRLAUTH) to NSMRL to enable SAHAP staff to brief ship and squadron personnel and provide kits."

Commander, Submarine Force, U.S. Pacific Fleet ltr 9510 Ser 475/214 dtd 28 July 2003

SAHAP's MISSION

To generate and communicate knowledge that will enhance air quality to promote health, prevent ***disease, performance decrement, and disability*** *in submariners even after their Navy service is over.*

February 1998

SAHAP's Tasks

1. **Construct and maintain database**
   - **Measure trace contaminants**
   - **Validate methodology**
   - **Compare results with limits**
2. **Scientific investigation into health effects**
   - **Carry out health surveillance**
3. **Support Fleet atmosphere issues**

Contributing Agencies

U. S. Navy
- NAVSEA
- NEHC
- NEPMU
- NRL
- TOXDET

Universities
- Massachusetts
- Old Dominion
- W. Kentucky

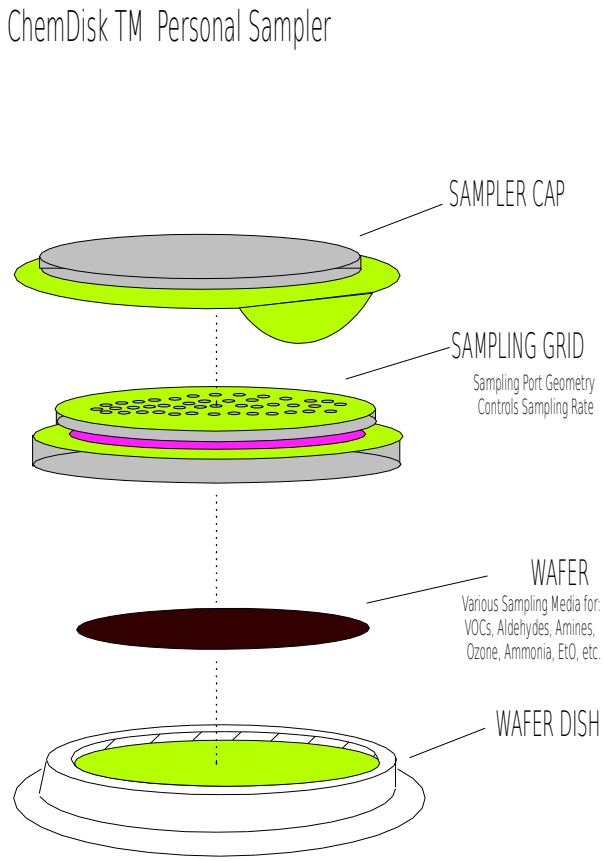
Certified laboratories
- Assay Tech- CA
- EHL - CT
- RTI - NC
- Battelle - OH

Contractors
- Sonalysts
- Geo-Centers
- Electric Boat

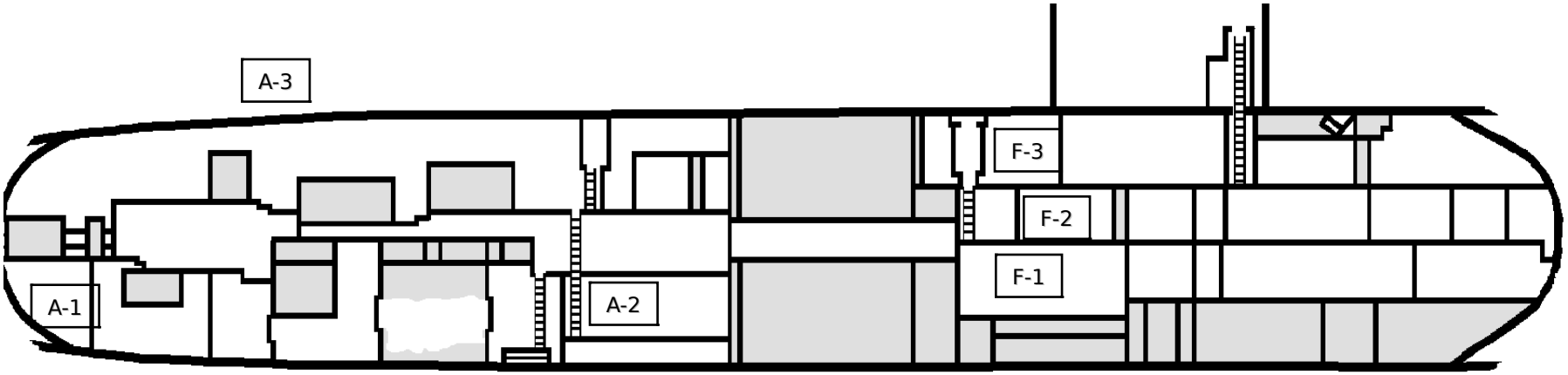
Technical Points

- **Passive sampling (current)**
  - Long-term low-level monitoring of trace atmospheric contaminants (e.g. TICs)
  - Respirable Suspended Particles (1-10 μm)
- **Future**
  - Help design real time monitoring strategy
  - Bioaerosol monitoring
  - Ultra fine particles

Passive Monitor



Sampling Locations



Aft Locations		Fwd Locations	
A-1	ER LL Aft (ASW Bay)	F-1	Aux Mach Rm 1 (Near Workbench)
A-2	ER LL Fwd (Secondary Sampling Station)	F-2	Crew's Mess
A-3	Maneuvering	F-3	Fan Rm (Aft Bulkhead)

Submariners at Risk (approx.)

TYPE	NUMBER	CREW	TOTAL
Virginia	1	~119	119
21	3	131	393
SSN	57	120	6840
SSBN	18	330	5940
TOTAL	79		13292
COHORT OF EX-SUBMARINERS			
1969 - 1982			~76000

Contaminants vs. Controls

AGENT	SOURCE	CONTROL
Hydrogen	Battery Charging	Catalytic Combustion
Carbon Dioxide	Crew members	Monoethanolamine
Carbon Monoxide	ETS, Fires	Catalytic Combustion
VOCs	Many	Catalytic Combustion Charcoal Filter
Particles	Crew/process/ETS	Filters
Water vapor	Crew/process	A/C Units
Smoke	Process/ETS/Fryer	Electrostatic ppt
Oil mist	Lube Oils/Fryer	Electrostatic ppt
Everything else	Many	"Strict Control"

SOURCE: NAS 1988

Acute vs Chronic Exposures

Acute Exposures:

- **Immediate, life threatening events**
- **CAMS I & II and Draeger tubes**

Chronic Exposures:

- **Long term, low-level exposures**
- **Not currently monitored routinely**

Target Compounds

Compounds from Table 3-5 of ACM:

√, T, TGA	Acetone	√, T	Methyl Chloroform (1,1,1-Trichloroethane)
T	Ammonia	√, T	Monoethanolamine (MEA)
√, T, TGA	Benzene (T, TGA)	T	Nitrogen Dioxide
C	Carbon Dioxide	C, P	Oxygen
C, T	Carbon Monoxide	√	Ozone (T)
	Chlorine	√, C	Refrigerant R-12 (Dichlorodifluoromethane)
	Hydrazine	√, C	Refrigerant R-114 (Dichlorotetrafluoroethane)
TGA	Total Aromatic Hydrocarbons (Less Benzene)	C	Refrigerant R-134a (1,1,1,2-Tetrafluoroethane)
TGA	Total Aliphatic Hydrocarbons (Less Methane)	T	Sulfur Dioxide
C	Hydrogen	√, T, TGA	Toluene
T	Hydrogen Chloride (Hydrochloric Acid)	TGA	Trichloroethylene
TGA	Isopropanol	TGA	Vinylidene Chloride
	Methanol	√, TGA	Xylene

√ = SAHAP Compound

C = CAMS

P = Portable Instrument

T = Tubes

TGA = Toxic Gas Analyzer

Compounds from Table 3-6 of ACM:

	Acetylene		Hydrogen Fluoride (Hydrofluoric Acid)
√	Acrolein		Mercury
	Arsine		Methane
	Ethanol		Refrigerant R-11 (Trichloromonofluoromethane)
	Ethylene		Stibine
√	Formaldehyde		

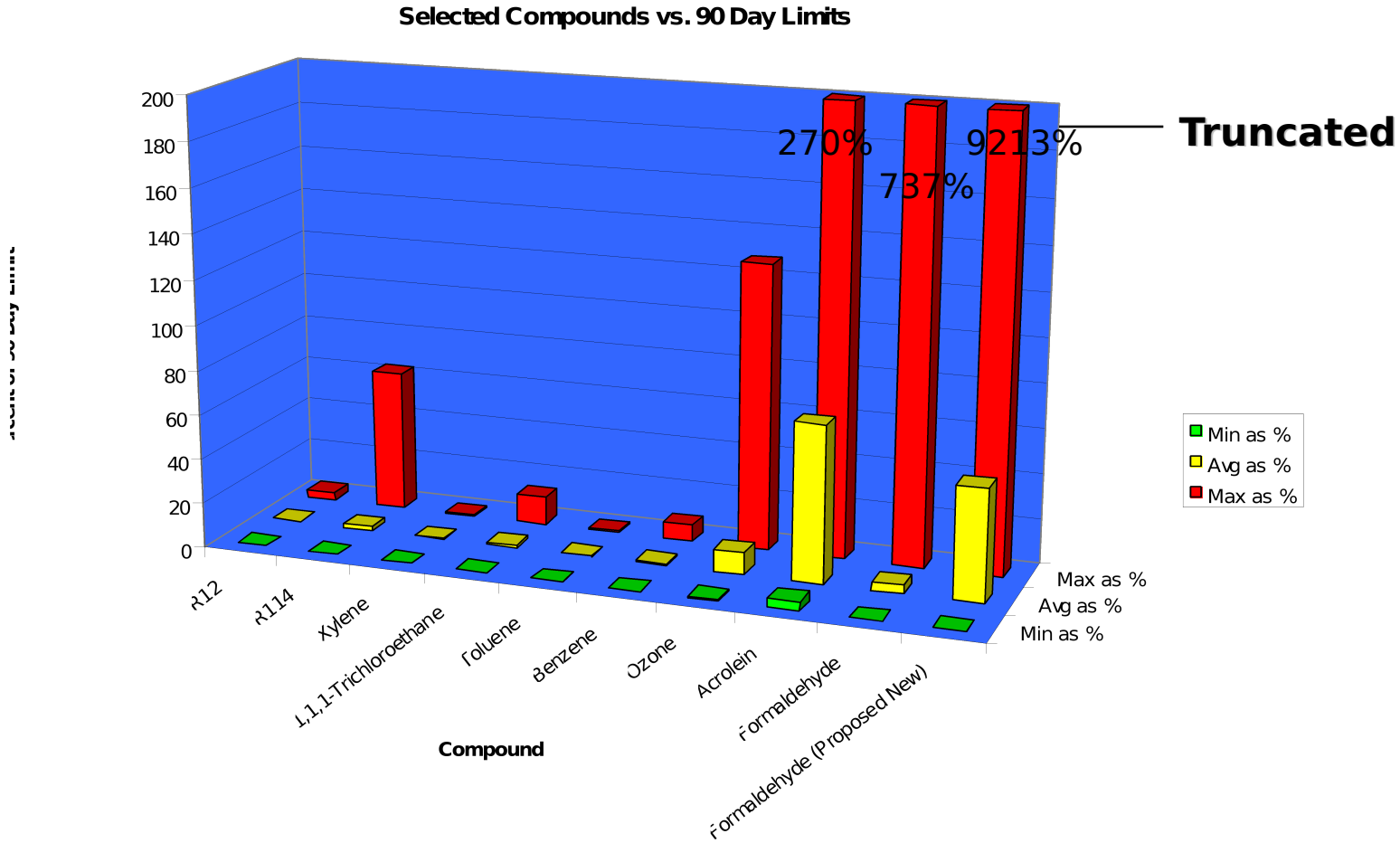
Target Compounds

Navy Environmental Health Center's
NEHC PROPOSED COMPOUNDS (240±)

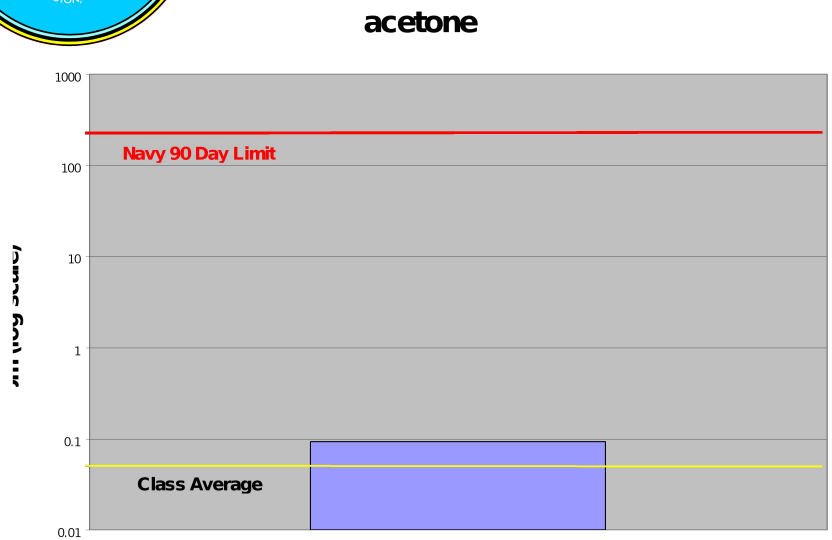
SPECIAL COMPOUNDS

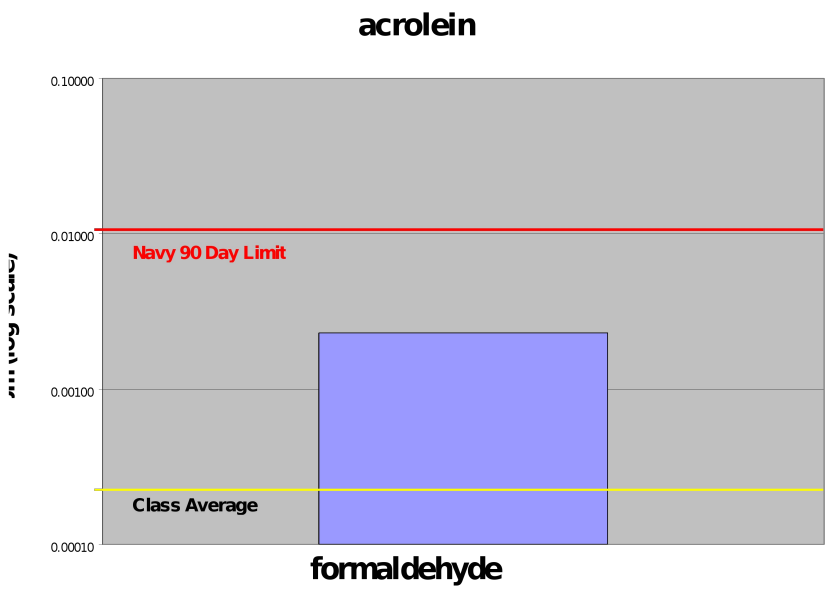
- Particulate matter
  - Respirable suspended particles (1-10 μm)
  - Ultra fine particles (<0.1 μm)
  - **Lead, Antimony, . . .)**

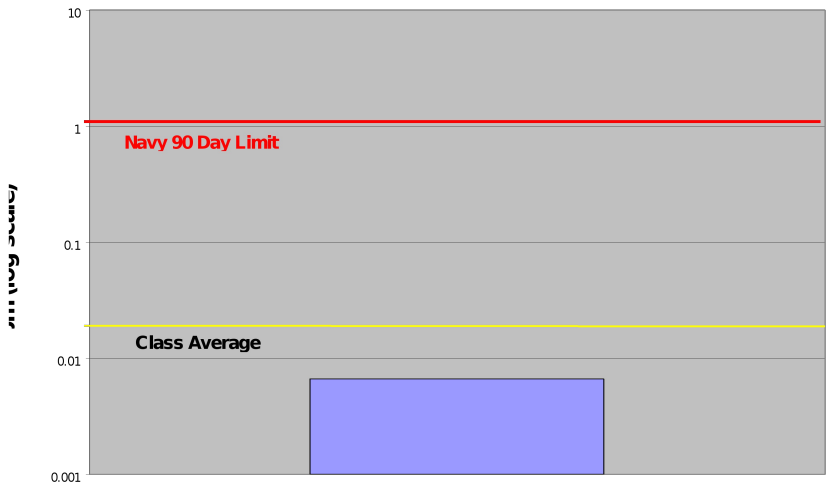
Contaminant Profiles

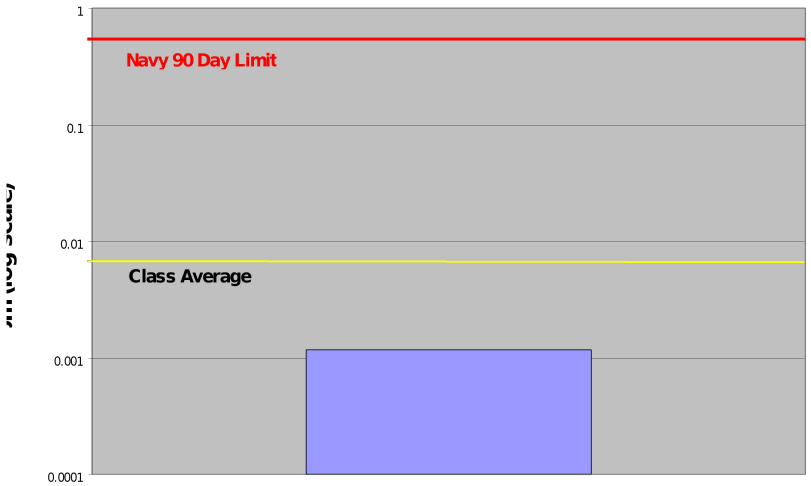


Typical Representation of Sampling Results USS XXX Boat/Squadron/Type Commander/NAVSEA/NEHC/BUMED









OSHA Requirements vs. Navy IH Sampling

	Hours/Day	Hours/Day Sampled	% Sampled
OSHA (Civilians)	**8**	**7**	**87%**
Current SAHAP	**24**	**24**	**~100%**
US Submarines Today (Draeger)	**24**	**<1**	**<4%**

Future USN convergence with OSHA requirements?

SAHAP's Products

Fundamental component of atmosphere control

- **Reports to Boat/Squadron/**
  Type Commander/NAVSEA/NEHC/BUMED
- **Confirmation of NAVSEA atmosphere control program success**
- **Fleet support (e.g. Lead, Stibine - SSN21, Virginia Atmosphere Sea Trials Study Design)**

SAHAP's Products

FUTURE

- **All boats should be routinely sampled on all deployments**
- **Health studies reassure sailors (families)_**
- **Effectiveness of engineering control**

SAHAP's Philosophy

ABSENCE OF EVIDENCE
IS NOT EVIDENCE OF ABSENCE!

Professor Ann Carey

THE END

Questions Please

FUTURE POTENTIAL

PROTECTING THOSE WHO SERVE

- **Strategy 1.** Use a systemic process to prospectively evaluate non battle related risks associated with the activities and settings of deployments.
- **Strategy 2.** Collect and manage environmental data and personnel location, biological samples, and activity data to facilitate analysis of deployment exposures and to support clinical care and public health-activities.
- **Strategy 3.** Develop the risk assessment, risk management, and risk communication skills of military leaders at all levels.
- **Strategy 4.** Accelerate implementation of a health surveillance system that spans the service life cycle and that continues after separation from service.
- **Strategy 5.** Implement strategies to address medically unexplained symptoms in populations that have deployed.
- **Strategy 6.** Implement a joint computerized patient record and other automated record keeping that meets the information needs of those involved with individual care and military public health.